Docket No.: HO-P02378US0
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Helene Derand, et al.

Application No.: Not Yet Assigned

Group Art Unit: N/A

Filed: February 26, 2002

Examiner: Not Yet Assigned

For: MICROFLUIDIC SURFACES

FIRST PRELIMINARY AMENDMENT

Box Patent Application
Commissioner for Patents
Washington, DC 20231

Dear Sir:

Prior to examination on the merits, please amend the above-identified U.S. patent application as follows:

In the Claims

Please substitute the following amended claims contained herein for claims 1-33. Applicants have included in Appendix A, a marked version of the claims to illustrate the changes contained herein.

1. (Amended) A microfluidic device comprising a set of one or more covered microchannel structures manufactured in the surface of a planar substrate, wherein non-specific adsorption and hydrophilicity are optimised by a coat exposing a non-ionic hydrophilic polymer on a part of the surface of at least one of the microchannel structures.

2. (Amended) The microfluidic device of claim 1, wherein the surface carrying the coat is made of organic or inorganic material.

3. (Amended) The microfluidic device of claim 1, wherein the surface of the planar substrate is made of plastics.

4. (Amended) The microfluidic device of claim 1, wherein the non-ionic hydrophilic polymer is attached covalently directly to the surface or to a polymer skeleton that is attached to the surface.

5. (Amended) The microfluidic device of claim 1, wherein the microfluidic device comprises more than five covered microchannel structures.

6. (Amended) The microfluidic device of claim 1, wherein each microchannel structures comprises a functional part selected from the group consisting of application cavity, conduit for liquid transport, reaction cavity, volume defining unit, mixing cavity, chamber for separating components of the sample, detection cavity.

7. (Amended) The microfluidic device of claim 6, wherein the non-ionic hydrophilic polymer is present on the surface of at least one of the functional parts and gives the surface a sufficient hydrophilicity for liquid to enter the part once having passed the entrance of the part.

8. (Amended) The microfluidic device of claim 1, wherein each microchannel structure comprises a microcavity having a volume ≤ 1 μl.

9. (Amended) The microfluidic device of claim 1, wherein mass transport of solutes and/or particles between different functional parts of each microchannel structure uses a liquid flow caused by non-electrokinetic forces.

10. (Amended) The microfluidic device of claim 1, wherein the device is a round disc.

11. (Amended) The microfluidic device of claim 1, wherein the non-ionic hydrophilic polymer is selected from the group of polymers consisting of hydroxy groups, ethylene oxy groups, and amide groups.

12. (Amended) The microfluidic device of claim 11, wherein the non-ionic hydrophilic polymer is a polyhydroxy polymer.

13. (Amended) The microfluidic device of claim 1, wherein the non-ionic hydrophilic polymer is selected from the group of consisting of polysaccharides, water-soluble derivatives of polysaccharides, polyvinyl alcohols, and poly(hydroxy alkyl vinylether) polymers.

14. (Amended) The microfluidic device of claim 1, wherein the non-ionic hydrophilic polymer is a reaction product between ethylene oxide and a dihydroxy or a polyhydroxy compound.

15. (Amended) The microfluidic device of claim 11, wherein the non-ionic hydrophilic polymer comprises one or more blocks of polyoxyethylene chains.

16. (Amended) The microfluidic device of claim 15, wherein the non-ionic hydrophilic polymer is polyethylene glycol.

17. (Amended) The microfluidic device of claim 11, wherein the non-ionic hydrophilic polymer is polyethylene glycol which has a methoxy group at the end which does not bind to the part surface.

18. (Amended) The microfluidic device of claim 11, wherein the non-ionic hydrophilic polymer comprises a plurality of amide groups.

19. (Amended) The microfluidic device of claim 1, wherein the non-hydrophilic polymer a polymerisate/copolymerisate with monomers selected from the group consisting of acrylamide, methacrylamide and vinylpyrrolidone.

20. (Amended) The microfluidic device of claim 1, wherein the non-ionic hydrophilic polymer is attached to a polymer skeleton that is attached to the part surface.

21. (Amended) The microfluidic device of claim 20 wherein the attachment between the non-ionic hydrophilic polymer and the polymer skeleton is covalent.

22. (Amended) The microfluidic device of claim 21, wherein the polymer skeleton is an inorganic or an organic polymer.

23. (Amended) The microfluidic device of claim 20, wherein the skeleton is selected from the group consisting of cationic, anionic, and neutral polymers.

24. (Amended) The microfluidic device of claim 20, wherein the skeleton is a polyamine.

25. (Amended) The microfluidic device of claim 20, wherein the skeleton is a polyethylene imine.

26. (Amended) The microfluidic device of claim 20, wherein the skeleton has a molecular weight 10,000-3,000,000 dalton.

27. (Amended) The microfluidic device of claim 1, wherein the surface of the planar substrate without the coat is made of plastics and the part surface without coat is hydrophilized by plasma treatment or by an oxidation agent in order to introduce functional groups that allow for a subsequent attachment of the coat onto the part surface.

28. (Amended) The microfluidic device of claim 1, wherein the surface of the planar substrate is made of plastics and that the plastics has a non-significant fluorescence for excitation wavelengths in the interval 200-800 nm and emission wavelengths in the interval 400-900 nm.

29. (Amended) The microfluidic device of claim 1, wherein the device is in a dry state that is capable of being rehydrated.

30. (Amended) A method of performing an analytical assay using the microfluidic device of claim 1 comprising one or more of the steps of:

preparing a sample;

running the assay reaction; and

detecting the result of the assay reaction, wherein the result is a measure of activity of the sample.

31. (Amended) A microfluidic device comprising a set of one or more covered microchannel structures manufactured in the surface of a planar substrate, wherein a part surface of at least one of the microchannel structures comprises a coat exposing a non-ionic hydrophilic polymer and that the surface of the planar substrate is made of plastics that comprises a non-significant fluorescence for excitation wavelengths in the interval 200-800 nm and emission wavelengths in the interval 400-900 nm.

32. (Amended) The microfluidic device of claim 31, wherein the plastics is based on a polymer of aliphatic monomers containing polymerizable carbon-carbon double bonds.

33. (Amended) The microfluidic device of claim 33, wherein the monomer is selected from the group consisting of a cycloalkane, norbornene or substituted norbornene, ethylene and propylene.

Please add new claims 34-41.

34. The microfluidic device of claim 3, wherein the plastics is based on a polymer of aliphatic monomers containing polymerizable carbon-carbon double bonds.

35. The microfluidic device of claim 34, wherein the monomer is selected from the group consisting of a cycloalkane, norbornene or substituted norbornene, ethylene and propylene.

36. The microfluidic device of claim 1, wherein mass transport of solutes and/or particles between different functional parts of each microchannel structure uses a liquid flow caused by electroendoosmosis.

37. The microfluidic device of claim 1, wherein the microchannel structures are excluded for use as sole capillaries in capillary electrophoresis.

38. A microfluidic device comprising a set of one or more covered microchannel structures manufactured in the surface of a planar substrate, wherein a part surface of at least one of the microchannel structures comprises a coat exposing a non-ionic hydrophilic polymer and that the surface of the planar substrate is made of plastics that is based on a polymer of aliphatic monomers containing polymerizable carbon-carbon double bonds.

39. The microfluidic device of claim 38 wherein the monomer is selected from the group consisting of cycloalkanes, norbornene or substituted norbornenes, ethylene and propylene.

40. The microfluidic device of claim 38 wherein the non-ionic hydrophilic polymer optimizes non-specific adsorption and hydrophilicity in relation to each other.

41. The microfluidic device of claim 38 wherein a microchannel structure comprises a functional part selected from the group consisting of application cavity, conduit for liquid transport, reaction cavity, volume defining unit, mixing cavity, cavity for separating components of the sample, detection cavity.

REMARKS

Claims 1-12 were in the original PCT application as filed. Claims 1-12 were amended in response to the Written Opinion of which claims 1-33 are now pending in the PCT application. Applicants have amended claims 1-33 to delete the multiple dependency and to clarify the claims without prejudice or acquiescence. Claims 34-41 have been added. Support for claims 34-35 can be found in the Specification on page 15, lines 4-7. Claim 36 is drawn to embodiments in original claim 9. Support for claim 37 can be found on in the Specification on page 2, lines 1-6. Support for claims 38-41 can also be found in the Specification on page 15, lines 4-7. Applicants have included a marked up version of the claims as amended herein as Appendix A. For the convenience of the Examiner, Applicants have included in Appendix B a copy of all pending claims as amended herein. Applicants assert that no new matter has been added.

CONCLUSION

Applicants have amended claims 1-33 to delete the multiple dependency and to clarify the claims without prejudice or acquiescence. Claims 34-41 have been added. No new matter was added. Therefore, these amendments do not narrow the scope of the claims within the meaning of *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., Ltd.*, 234 F.3d 558, 586, 56 USPQ2d 1865, 1886 (Fed. Cir. 2000).

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

Application No.: Not Yet Assigned

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Applicant believes no fee is due with this response. However, if a fee is due, please charge our Deposit Account No. 06-2375, under Order No. 10201472 from which the undersigned is authorized to draw.

Dated: February 26, 2002

Respectfully submitted,

By _____

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Appendix A
Version With Markings to Show Changes Made

1. (Amended) A microfluidic device comprising a set of one or more covered microchannel structures manufactured in the surface of a planar substrate, ~~with the provison that sole capillaries, possibly with an area for application and an area for detection, as used in capillary electrophoresis are excluded from being a microfluidic device, characterized~~, wherein ~~in that~~ non-specific adsorption and hydrophilicity ~~have been~~are optimised by a coat exposing a non-ionic hydrophilic polymer on a part of the surface of at least one of the microchannel structures.

2. (Amended) The microfluidic device of claim 1, ~~characterized in that~~ wherein the surface carrying the coat is made of organic or inorganic material.

3. (Amended) The microfluidic device of ~~any of~~ claim~~s~~ 1~~-2~~, ~~characterized in that~~ wherein the surface of the planar substrate is made of plastics.

4. (Amended) The microfluidic device of ~~any of~~ claim~~s~~ 1~~-3~~, ~~characterized in that~~ wherein the non-ionic hydrophilic polymer is attached covalently directly to the surface or to a polymer skeleton that is attached to the surface.

5. (Amended) The microfluidic device of ~~any one of~~ claim~~s~~ 1~~-4~~, ~~characterized in that~~ wherein ~~there are more than~~the microfluidic device comprises more than five covered microchannel structures.

6. (Amended) The microfluidic device of ~~any of~~ claim~~s~~ 1~~-5~~, ~~characterized in that~~ wherein each microchannel structures comprises a functional part selected from the group consisting of ~~amongst (a)~~ application ~~chamber or~~ cavity, ~~(b)~~ conduit for liquid transport, ~~(c)~~ reaction ~~chamber or~~ cavity, ~~(d)~~ volume defining unit, ~~(e)~~ mixing ~~chamber or~~ cavity, ~~(f)~~ chamber for separating components of the sample, ~~(g)~~ detection ~~chamber or~~ cavity.

7. (Amended) The microfluidic device of ~~any of~~ claims ~~1~~-6, ~~characterized in that~~wherein the non-ionic hydrophilic polymer is present on the surface of at least one of ~~said~~ the functional parts and gives the surface a sufficient hydrophilicity for liquid to enter the part once having passed the entrance of the part.

8. (Amended) The microfluidic device of ~~any of~~ claims 1-~~7~~, ~~characterized in~~wherein ~~that~~ each microchannel structure comprises a microcavity having a volume ≤ 1 µl.

9. (Amended) The microfluidic device of ~~any of~~ claims 1-~~8~~, ~~characterized in that~~wherein mass transport of solutes and/or particles between different functional parts of each microchannel structure uses a liquid flow ~~driven~~ caused by ~~a)~~ non-electrokinetic forces. ~~and/or b) electroendoosmosis.~~

10. (Amended) The microfluidic device of ~~any of~~ claims 1-~~9~~, ~~characterized in that~~wherein the device is a round disc ~~and that the liquid flow is driven by capillary action, centripetal force (spinning the disc) and/or hydrodynamically~~.

11. (Amended) The microfluidic device of ~~any of~~ claims 1-~~10~~, ~~characterized in that~~wherein the non-ionic hydrophilic polymer is selected ~~amongst~~ from the group of polymers consisting of ~~polymers containing a plurality of~~ hydroxy groups, ethylene oxy groups, and amide groups.

12. (Amended) The microfluidic device of claim 11, ~~characterized in that~~wherein the non-ionic hydrophilic polymer is a polyhydroxy polymer.

13. (Amended) The microfluidic device of claim ~~11~~1, ~~characterized in that~~wherein the non-ionic hydrophilic polymer is selected ~~amongst~~ from the group of

consisting of polysaccharides ~~and~~, water-soluble derivatives of polysaccharides ~~thereof~~, polyvinyl alcohols, and poly(hydroxy alkyl vinylether) polymers.

14. (Amended) The microfluidic device of claim ~~11~~1, ~~characterized in that~~wherein the non-ionic hydrophilic polymer is a reaction product between ethylene oxide and a dihydroxy or a polyhydroxy compound.

15. (Amended) The microfluidic device of claim 11, ~~characterized in that~~wherein the non-ionic hydrophilic polymer comprises one or more blocks of polyoxyethylene chains.

16. (Amended) The microfluidic device of claim ~~11~~15, ~~characterized in that~~wherein the non-ionic hydrophilic polymer is polyethylene glycol.

17. (Amended) The microfluidic device of claim 11, ~~characterized in that~~wherein the non-ionic hydrophilic polymer is polyethylene glycol which has a methoxy group at the end which does not bind ~~directly~~ to the part surface ~~or to the skeleton, if present~~.

18. (Amended) The microfluidic device of claim 11, ~~characterized in that~~wherein the non-ionic hydrophilic polymer comprises a plurality of amide groups.

19. (Amended) The microfluidic device of claim ~~11~~1, ~~characterized in that~~wherein the non-hydrophilic polymer a polymerisate/copolymerisate with monomers selected from the group consisting of ~~at least~~ acrylamide, methacrylamide and vinylpyrrolidone.

20. (Amended) The microfluidic device ~~according to any~~ of claim~~s~~ 1~~-20~~, ~~characterized in that~~wherein the non-ionic hydrophilic polymer is attached to a polymer skeleton that is attached to the part surface.

21. (Amended) The microfluidic device of claim 20 ~~characterized in that said~~wherein the attachment between the non-ionic hydrophilic polymer and the polymer skeleton is covalent.

22. (Amended) The microfluidic device of claim 21, ~~characterized in that said~~wherein the polymer skeleton is an inorganic or an organic polymer.

23. (Amended) The microfluidic device of ~~any of~~ claim~~s~~ 20~~-22~~, ~~characterized in that said~~wherein the skeleton is selected ~~among~~ from the group consisting of cationic, anionic, and neutral polymers.

24. (Amended) The microfluidic device of ~~any of~~ claim~~s~~ 20~~-23~~, ~~characterized in that said~~wherein the skeleton is ~~selected among polymers that are~~a polyamine~~s~~.

25. (Amended) The microfluidic device of ~~any of~~ claim~~s~~ 20~~-24~~, ~~characterized in that said~~wherein the skeleton is a polyethylene imine.

26. (Amended) The microfluidic device of ~~any of~~ claim~~s~~ 20~~-25~~, ~~characterized in that~~ wherein the skeleton has a molecular weight 10,000-3,000,000 dalton.

27. (Amended) The microfluidic device ~~according any~~ of claim~~s~~ 1~~-26~~, ~~characterized in that~~wherein the ~~substrate~~ surface of the planar substrate without the coat is made of plastics and ~~that said~~ the part surface without coat is hydrophilized by plasma treatment or by an oxidation agent in order to introduce functional groups that allow for a subsequent attachment of the coat onto ~~said~~ the part surface.

28. (Amended) The microfluidic device ~~according to any~~ of claim~~s~~ 1~~-27~~, ~~characterized in that in that~~ wherein the surface of the planar substrate is made of plastics and

that the plastics has a non-significant fluorescence for excitation wavelengths in the interval 200-800 nm and emission wavelengths in the interval 400-900 nm.

29. (Amended) The microfluidic device ~~according to any~~ of claim~~s~~ 1-~~28~~, ~~characterized in that~~wherein ~~it is in a dried state~~the device is in a dry state that is capable of being rehydrated.

30. (Amended) A method of performing an analytical assay using the microfluidic device of claim 1 comprising ~~the~~one or more of the steps of~~The use of the microfluidic device of any of claims 1-29 in analytical systems in which an assay comprising one or more of the steps of~~:

preparing a sample ~~preparation;~~,

running the assay reaction; and

detecting the result of the assay reaction, wherein the result is a measure of activity of the sample~~detection,~~

~~at least one and preferably more than two of said steps being carried out within the microfluidic device~~.

31. (Amended) A microfluidic device comprising a set of one or more~~, preferably more than 5,~~ covered microchannel structures manufactured in the surface of a planar substrate, ~~characterized in that~~wherein a part surface of at least one of the microchannel structures ~~has a~~comprises a coat exposing a non-ionic hydrophilic polymer and that the surface of the planar substrate is made of plastics that ~~has~~ comprises a non-significant fluorescence for excitation wavelengths in the interval 200-800 nm and emission wavelengths in the interval 400-900 nm.

32. (Amended) The microfluidic device of claim 31, ~~characterized in that~~wherein the plastics is based on a polymer of aliphatic monomers containing polymerizable carbon-carbon double bonds.

33. (Amended) The microfluidic device of claim 33, ~~characterized in that~~wherein the monomer is selected ~~among~~ from the group consisting of~~is~~ a cycloalkane, norbornene or substituted norbornene, ethylene and propylene.

APPENDIX B
CLAIMS PENDING AS OF FEBRUARY

1. (Amended) A microfluidic device comprising a set of one or more covered microchannel structures manufactured in the surface of a planar substrate, wherein non-specific adsorption and hydrophilicity are optimised by a coat exposing a non-ionic hydrophilic polymer on a part of the surface of at least one of the microchannel structures.

2. (Amended) The microfluidic device of claim 1, wherein the surface carrying the coat is made of organic or inorganic material.

3. (Amended) The microfluidic device of claim 1, wherein the surface of the planar substrate is made of plastics.

4. (Amended) The microfluidic device of claim 1, wherein the non-ionic hydrophilic polymer is attached covalently directly to the surface or to a polymer skeleton that is attached to the surface.

5. (Amended) The microfluidic device of claim 1, wherein the microfluidic device comprises more than five covered microchannel structures.

6. (Amended) The microfluidic device of claim 1, wherein each microchannel structures comprises a functional part selected from the group consisting of application cavity, conduit for liquid transport, reaction cavity, volume defining unit, mixing cavity, chamber for separating components of the sample, detection cavity.

7. (Amended) The microfluidic device of claim 6, wherein the non-ionic hydrophilic polymer is present on the surface of at least one of the functional parts and gives the surface a sufficient hydrophilicity for liquid to enter the part once having passed the entrance of the part.

8. (Amended) The microfluidic device of claim 1, wherein each microchannel structure comprises a microcavity having a volume ≤ 1 μl.

9. (Amended) The microfluidic device of claim 1, wherein mass transport of solutes and/or particles between different functional parts of each microchannel structure uses a liquid flow caused by non-electrokinetic forces.

10. (Amended) The microfluidic device of claim 1, wherein the device is a round disc.

11. (Amended) The microfluidic device of claim 1, wherein the non-ionic hydrophilic polymer is selected from the group of polymers consisting of hydroxy groups, ethylene oxy groups, and amide groups.

12. (Amended) The microfluidic device of claim 11, wherein the non-ionic hydrophilic polymer is a polyhydroxy polymer.

13. (Amended) The microfluidic device of claim 1, wherein the non-ionic hydrophilic polymer is selected from the group of consisting of polysaccharides, water-soluble derivatives of polysaccharides, polyvinyl alcohols, and poly(hydroxy alkyl vinylether) polymers.

14. (Amended) The microfluidic device of claim 1, wherein the non-ionic hydrophilic polymer is a reaction product between ethylene oxide and a dihydroxy or a polyhydroxy compound.

15. (Amended) The microfluidic device of claim 11, wherein the non-ionic hydrophilic polymer comprises one or more blocks of polyoxyethylene chains.

16. (Amended) The microfluidic device of claim 15, wherein the non-ionic hydrophilic polymer is polyethylene glycol.

17. (Amended) The microfluidic device of claim 11, wherein the non-ionic hydrophilic polymer is polyethylene glycol which has a methoxy group at the end which does not bind to the part surface.

18. (Amended) The microfluidic device of claim 11, wherein the non-ionic hydrophilic polymer comprises a plurality of amide groups.

19. (Amended) The microfluidic device of claim 1, wherein the non-hydrophilic polymer a polymerisate/copolymerisate with monomers selected from the group consisting of acrylamide, methacrylamide and vinylpyrrolidone.

20. (Amended) The microfluidic device of claim 1, wherein the non-ionic hydrophilic polymer is attached to a polymer skeleton that is attached to the part surface.

21. (Amended) The microfluidic device of claim 20 wherein the attachment between the non-ionic hydrophilic polymer and the polymer skeleton is covalent.

22. (Amended) The microfluidic device of claim 21, wherein the polymer skeleton is an inorganic or an organic polymer.

23. (Amended) The microfluidic device of claim 20, wherein the skeleton is selected from the group consisting of cationic, anionic, and neutral polymers.

24. (Amended) The microfluidic device of claim 20, wherein the skeleton is a polyamine.

25. (Amended) The microfluidic device of claim 20, wherein the skeleton is a polyethylene imine.

26. (Amended) The microfluidic device of claim 20, wherein the skeleton has a molecular weight 10,000-3,000,000 dalton.

27. (Amended) The microfluidic device of claim 1, wherein the surface of the planar substrate without the coat is made of plastics and the part surface without coat is hydrophilized by plasma treatment or by an oxidation agent in order to introduce functional groups that allow for a subsequent attachment of the coat onto the part surface.

28. (Amended) The microfluidic device of claim 1, wherein the surface of the planar substrate is made of plastics and that the plastics has a non-significant fluorescence for excitation wavelengths in the interval 200-800 nm and emission wavelengths in the interval 400-900 nm.

29. (Amended) The microfluidic device of claim 1, wherein the device is in a dry state that is capable of being rehydrated.

30. (Amended) A method of performing an analytical assay using the microfluidic device of claim 1 comprising one or more of the steps of:

preparing a sample;

running the assay reaction; and

detecting the result of the assay reaction, wherein the result is a measure of activity of the sample.

31. (Amended) A microfluidic device comprising a set of one or more covered microchannel structures manufactured in the surface of a planar substrate, wherein a part surface of at least one of the microchannel structures comprises a coat exposing a non-ionic hydrophilic polymer and that the surface of the planar substrate is made of plastics that comprises a non-significant fluorescence for excitation wavelengths in the interval 200-800 nm and emission wavelengths in the interval 400-900 nm.

32. (Amended) The microfluidic device of claim 31, wherein the plastics is based on a polymer of aliphatic monomers containing polymerizable carbon-carbon double bonds.

33. (Amended) The microfluidic device of claim 33, wherein the monomer is selected from the group consisting of a cycloalkane, norbornene or substituted norbornene, ethylene and propylene.

34. The microfluidic device of claim 3, wherein the plastics is based on a polymer of aliphatic monomers containing polymerizable carbon-carbon double bonds.

35. The microfluidic device of claim 34, wherein the monomer is selected from the group consisting of a cycloalkane, norbornene or substituted norbornene, ethylene and propylene.

36. The microfluidic device of claim 1, wherein mass transport of solutes and/or particles between different functional parts of each microchannel structure uses a liquid flow caused by electroendoosmosis.

37. The microfluidic device of claim 1, wherein the microchannel structures are excluded for use as sole capillaries in capillary electrophoresis.

38. A microfluidic device comprising a set of one or more covered microchannel structures manufactured in the surface of a planar substrate, wherein a part surface of at least one of the microchannel structures comprises a coat exposing a non-ionic hydrophilic polymer and that the surface of the planar substrate is made of plastics that is based on a polymer of aliphatic monomers containing polymerizable carbon-carbon double bonds.

39. The microfluidic device of claim 38 wherein the monomer is selected from the group consisting of cycloalkanes, norbornene or substituted norbornenes, ethylene and propylene.

40. The microfluidic device of claim 38 wherein the non-ionic hydrophilic polymer optimizes non-specific adsorption and hydrophilicity in relation to each other.

41. The microfluidic device of claim 38 wherein a microchannel structure comprises a functional part selected from the group consisting of application cavity, conduit for liquid transport, reaction cavity, volume defining unit, mixing cavity, cavity for separating components of the sample, detection cavity.